

# The biology of happiness

Chasing pleasure and human destiny

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Happiness has become a major topic of interest in both affluent and developing countries. Regular surveys measure the general happiness of populations to determine which country cares best for its citizens—Norway often comes out on top. Economists have even considered replacing GDP as a measure of wealth and success with a new ‘happiness’ factor that would expand a country’s success beyond purely financial and economic measures. Happiness has even gained stature as a subject of research and moved from a minor branch of psychology and economic studies to the fore of contemporary sciences. Can happiness be observed and measured? Generally, it is measured as subjective well-being, based on questionnaires. Can biology have its share in the ‘new science of happiness’?

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The trouble is that the subject itself is fuzzy. The term happiness might be equated to utility, well-being, life satisfaction and welfare [1]. The US psychologist Martin Seligman, who had written the book *Authentic Happiness*, in his newest book concedes: “I actually detest the word happiness, which is so overused that it has become almost meaningless. It is an unworkable term for science” [2]. He has proposed the alternative terms flourishing, well-being, meaning, love and growth. My essay conceives of happiness as a total and

lasting satisfaction with one’s own life [3]. Happiness is more than the absence of unhappiness. Happiness is experienced both as fleeting sensations and emotions, and consciously appreciated as a permanent disposition of the mind. It encompasses two inseparable aspects: hedonia (pleasure of the senses) and eudaimonia (pleasure of reason: living well and doing well).

In my younger days, working as a researcher in molecular biology, I would have scorned any scientist pursuing a subject as vague as happiness. However, living in a totalitarian state and being dismissed from a university in a political purge in 1970, I took it as a challenge to examine what makes people unhappy and how to make them happy. I soon settled on the commonplace: everything of happiness has already been said in antiquity. Recently, the British historian Richard Schoch contended that contemporary attempts at constituting a science of happiness are based on flawed premises and fall short of the understanding of happiness that even the average sage of antiquity took as fundamental [4].

Yet, the present situation is different from ancient times. The past two centuries have seen the emergence of Darwin’s theory of evolution, the rise of capitalism, the invention of anaesthesia and analgesia and of efficient contraception. In our days, the rapid progress of neurobiology also enables neurobiologists to analyse the neural underpinning of happiness and might well offer new technologies to achieve ‘artificial happiness’ in the future. In democratic societies, the well-being of the masses—happiness for everybody—has become the focus of the ‘new science of happiness’ and a main agenda of the state.

**Darwin speculated that the emotions must be key to the survival of the fittest**

Darwin’s discovery that humans have common origins with other animals has been widely acknowledged, but much less has his insight that human reasoning comprises emotions as inseparable constituents. Darwin speculated that the emotions must be key to the survival of the fittest [5]. This view was disregarded in philosophy and science for decades, but recently an ‘affective revolution’ in cognitive sciences has changed the perspective: “cognition refers to a language for describing all the brain operations, including emotions and reasoning” [6].

Emotions are the singular normative device that attributes meaning to things and actions in the world. They serve as a universal dichotomist qualifier; classifying data, received by sensors, as ‘good’—beneficial, or ‘bad’—noxious. They induce an organism to actively seek beneficial stimuli as ‘rewards’ or actively evade noxious stimuli to avoid ‘punishment’. According to the Canadian neurobiologist Peter Shizgal, emotions play a role in the ‘calculation of utility’; they set preferences [7]. The term ‘utility’, as he uses it, has the same meaning as it has in contemporary economics and decision theory: an organism is a rational consumer that will prefer different ‘commodities’ that serve its Darwinian fitness—food or sex, depending on its immediate needs. We might call the utility that serves Darwinian fitness the ‘Darwinian utility’. Emotions also function as ‘commitment devices’; they commit an individual organism to behave consistently

with previous experiences, running counter to speciously attractive immediate rewards [8,9]. Emotions enable learning: the frequency of an appropriate behaviour is increased by positive ‘reinforcement’ and the frequency of an opposite, inappropriate behaviour is decreased by ‘punishment’.

Very simple creatures make do without emotions. However, once an organism is able to respond to its environment adaptively by learning, it needs both sensors to measure the state of its environment and emotions as more general situation detectors. Simple organisms are not aware of their own emotions. As the evolution of animals progressed, a phenomenal consciousness might have allowed them to dimly appreciate ‘bad’ emotions as painful and ‘good’ emotions as pleasing, allowing an individual animal to experience ‘this is painful’, but without a personal awareness of ‘I feel pain’. As the French theologian and anthropologist Pierre Teilhard de Chardin [10] put it, “No doubt, an animal knows. But it certainly does not know that it knows. [...] A gulf—or a threshold—insurmountable for it divides us.”

Human self-consciousness changes a considerable part of emotions into feelings; that is, self-conscious emotions. A human individual feels a ‘bad’ or negative emotion as his/her own pain and a ‘good’ or positive emotion as his/her own pleasure. Thus, the awareness that a particular emotion is ‘my own emotion’ is an important, and possibly constituent, part of self-consciousness. “Human conscious experience of pleasure is different not only quantitatively but also qualitatively from other animals, depending on the uniqueness of human cortical mechanisms involved in the conversion into consciousness” [11]. The same apparently applies to pain [12].

In humans, as in other animals, the two kinds of emotion—positive and negative—have specific locations in the brain. Positive emotions are associated with the ‘centres of reward’ and negative emotions with the ‘centres of punishment’. Olds and Milner first identified sites in the rat brain in which direct electrical stimulation triggered positive reinforcement and reward [13]. However, it would be misleading to call the reward centres of non-human brains the ‘pleasure centres’ or to claim that animals ‘seek pleasure’ or that pleasure functions as a ‘common currency’.

Many of these sites were subsequently linked through a common neural pathway

in the evolutionarily ancient, subcortical limbic system, the medial forebrain bundle, as it courses through the lateral hypothalamus to the ventral tegmentum and nucleus accumbens [14]. Other brain reward ‘spots’, in particular those comprised of the cortical regions and subcortical nuclei, might eventually converge at this limbic core site [7,11]. The brain ‘punishment’ centres might have evolved from a primitive brain system responsible for body health, in particular physical damage [12].

### With the emergence of self-awareness, emotions have become a new evolutionary force

Experiencing pain and pleasure in humans not only involves these evolutionarily older parts of the brain, common to all vertebrates, but also is inextricably linked with the latest evolutionary innovation—the neocortex—that is, the part of the brain that is responsible for self-consciousness. The brain is “the organ by which we experience the world—that is, we feel pain and pleasure, we yearn, and in order to find out how to minimize pain and maximize pleasure, we think” [15]. “The first step in generation of emotions in humans is represented by unconscious, implicit evaluation of a stimulus, followed by physiological responses, and the second step is a conscious experience that may or may not persist...” [16].

With the emergence of self-awareness, emotions have become a new evolutionary force. It seems appropriate to call this new mode of human evolution the ‘emotional evolution’. Emotional evolution must have initially served Darwinian fitness by increasing the likelihood that an organism would live long enough to reproduce. However, in analogy with sexual evolution, emotion and emotion-seeking have escalated in a runaway manner, often exaggerating traits away from their naturally selected optimum. Darwin himself contended that primaevial emotions, more than natural selection, drove the evolution of civilization [17]. “Avoiding pain and seeking pleasure, by a runaway process of emotional evolution, might have made humans a unique hedonotropic species—one which seeks to amplify sensations they experience as pleasant—and might thus have become the main driver of subsequent cultural evolution” [18]. Cultural evolution,

which is many orders of magnitude faster than biological evolution, must have substantially divorced the roles of emotion in promoting Darwinian fitness and allowing their functioning by themselves, as sort of an evolutionary *l’art pour l’art*. The emotional ‘good’, has become detached from the Darwinian ‘good’ such that experiencing pleasure has become an end in itself. The Darwinian utility has been displaced by the hedonic utility. Humans have become a uniquely hyperemotional animal species.

One might expect that this would make an individual human being an extremely self-centred and egotistical creature. But, in fact, other people have become the main source, and also the main target, for emotions. Humans, the hyperemotional animals are also hyper- or ultra-social [19–21]. As a species we can be loosely characterized as eusocial [22], similar to bees and ants [23]. Yet the human brand of altruism is species-specific and largely different from that exhibited by other animals: humans are able to experience and understand not only their own emotions, but also the emotions of others. A human being shows “a tender concern for the source of one’s organic pleasure” [24]. This concern is associated with evolutionarily new social emotions such as shame and guilt: “these new social instincts were superimposed onto human psychology without eliminating those that favour friends and kin” and “eventually embrace group abstract symbolic marking, such as language, totem, group myth and ideology” [21]. Yet, physical and social pain are the same to the human brain as are direct sensory pleasures and ‘psychological’ pleasures that originate in memory, imagination and anticipation.

### The emotional ‘good’ has become detached from the Darwinian ‘good’, such that experiencing pleasure has become an end in itself

The human animal is therefore not ‘ego-centric’, as usually claimed, but ‘altero-centric’ [25,26], continually caring for the emotions of others, or even seeing himself or herself through the eyes of others. “Concern about relative positions is a deep-rooted and ineradicable element of human nature” [27]. Our nervous systems are not self-contained, but attuned to those around us and those close to us; we mutually

experience ‘limbic resonance’ [28]. Other people are also principal sources of social alarm and thus of psychological stress. It is here that the great advantage of the neocortex becomes apparent: it functions as an arbitrator to attribute quality and strength to social factors. The thoughts and actions of a particular individual can render us excited or leave us indifferent. Envy, which British philosopher Bertrand Russell thought was “one of the most potent causes of unhappiness” [29], can be tempered or neutralized by mobilizing the neocortex. But the main source of stress for the human primate is probably fear and the subjective sense of uncertainty, so the satisfaction of the need for security is a precondition for the unfolding of all other needs.

**H**yperemotionality and hypersociality have considerably enlarged human biological needs. The US psychologist Abraham Maslow coined the name ‘metaneeds’ and identified them with intrinsic human values, which he supposed to be ‘instinctoid’. These metaneeds are directed towards metavalues such as truth, beauty, perfection, justice, order, playfulness and meaningfulness. They enable spiritual or transcendent life, which is “clearly rooted in the biological nature of the species. It is a kind of ‘higher’ animality whose precondition is a healthy ‘lower’ animality, that is, they are hierarchically integrated (rather than mutually exclusive)” [30].

A human individual proceeds through life driven by a permanent hedonic gradient. The gradient is sustained by alternating negative and positive emotions. Each of us has his or her idiosyncratic baseline, fixed by genes and possibly by early personal ontogenesis, which determines our subjective experience of emotions in the form of feelings [31]. Feelings oscillate around this baseline, which establishes the total appreciation of one’s own life. Activities of reasoning, discovering, inventing and collecting knowledge can be sources of great pleasure or pain. Moreover, in contrast to other animals, only humans are able to feel pleasure by imagining both past and future pleasures. These capacities of mental self-projection into the past, the future, or the perspective of another individual all enable a specifically human way of life: living within time [32]. Furthermore, a loop connects our goals and our motives for attaining them: many goals become self-rewarding. Our worldviews are heavily emotion-laden,

and, in extreme cases, we will sacrifice our personal life for our cause. Jones compared self-sacrificing heroism to “almost sexual enjoyment” [33] and Gopnik used the term “explanation as orgasm” [34].

**P**robably a main part of all human emotions never enter consciousness. Unconscious emotions influence people’s preferences and can influence behaviour, despite the absence of subjective feelings [35]. Indeed, the ‘immense ocean’ of our unconscious emotions might substantially determine why we are champions of self-deception [36] and why, as the ethologist Konrad Lorenz used to say, “to believe in a sheer nonsense is a privilege of man” [37].

According to Lorenz, “pleasure-accentuated actions and activities soar to the heights of becoming ends in themselves” [38]. He referred to the ideas of Karl Bühler, who first noticed human *Funktionslust*—pleasure in function. “All value judgments are based on emotional processes. The free play of emotion is a prerequisite for all truly creative processes; those of human culture as well as those of evolution.” But Lorenz warned: “*Funktionslust* in its original form is a blessing for mankind but that, within the circumstances and conditions of an overorganized mass society, can become a curse.”

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The US behaviourist Burrhus Frederic Skinner vividly depicts this curse in an essay that, though it deals with the western world, applies universally. “The West is especially rich in the things we call interesting, beautiful, delicious, entertaining, and exiting. They make daily life more reinforcing, but they reinforce little more than the behaviour that brings one into contact with them. [...] Although we look at a nude statue in part because a tendency to look at similar forms has played a part in survival of the species, looking does not have that effect in this instance. [...] What is wrong with life in the West is not that it has too many reinforcers, but that they are not contingent on the kinds of behaviour that sustain the

individual or promote the survival of the culture or species” [39].

This is the situation that has been created by the capitalistic economy. It seems that achieving zero pain and maximum pleasure has driven the evolution of the modern economy at all levels. A simple equation defines these enterprises: happiness = pleasure. It is conceivable that contemporary economists might give up their canonical conception of ‘utility’, described above, and return to the original concept of utility introduced by the founder of utilitarianism, Jeremy Bentham, who considered utility as the net sum of the positive emotions, minus the negative ones [40]. Indeed, the title of a recent paper by the psychologist and economist Daniel Kahneman and his co-workers [41] poses a question: “Back to Bentham?” In respect to happiness, utilitarianism is the promulgator of sheer hedonia.

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The equation above also seems to serve as the foundation for many contemporary scientific approaches to happiness. As Kringelbach & Berridge point out, the techniques available to contemporary science make the hedonic aspect of happiness more tractable; and, accordingly, they have ventured to treat the neuroscience of happiness as the neuroscience of pleasure, albeit admitting that a “pleasant mood is only half the happiness story” [11].

**T**he notion of happiness as limitless pleasure runs counter to a fundamental biological fact: biological sensing systems are designed to respond to changes in the incoming stimuli, rather than to the magnitude of a stimulus. In the presence of a maintained stimulus, receptor sensitivity decreases, which is known as sensory accommodation. In humans, sensory accommodation has its counterpart in ‘hedonic accommodation’ [18]. Analogous with sensory accommodation, the emotional responses to a pleasant stimulus also weaken or completely cease, if a stimulus remains constant. This phenomenon has been called the hedonic treadmill (Fig 1; [42]).

Positive emotions serve as a lure to engage in certain behaviours, but they cease

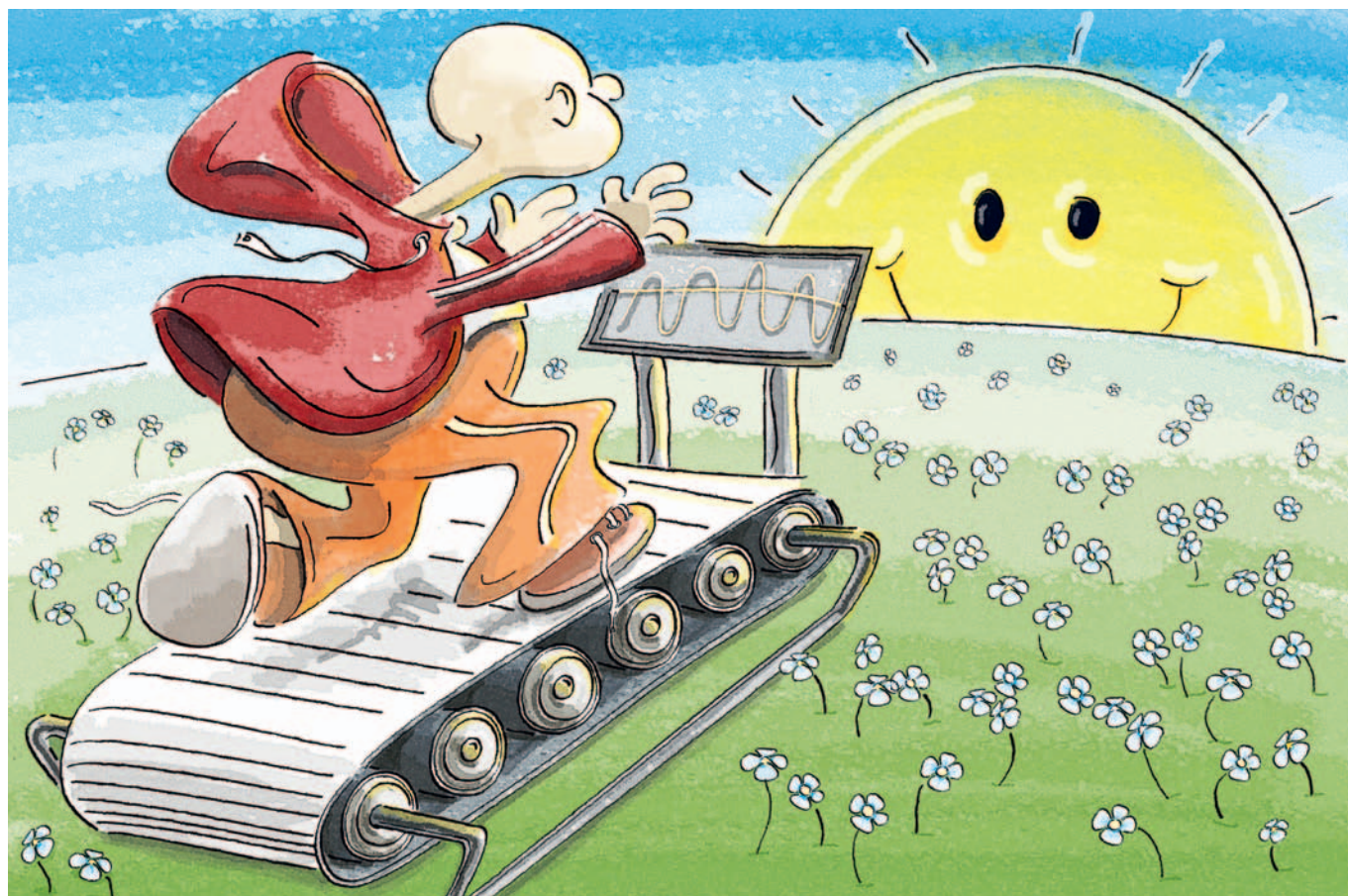


Fig 1 | The hedonic treadmill.

once the need or want driving them has been satisfied. However, the memory of the pleasant moment remains and we want to experience it again. In this sense, pain and pleasure are not symmetrical, nor is the absence of both pain and pleasure a normal state. The normal state is to be sensitive to pain and to yearn for pleasure. We have been moulded by evolution not to be happy, but to act on the phantasm of happiness. Indeed the debate about the motivating strengths of positive and negative emotions has gone on for as long as humankind has been able to express itself.

Yet, emotional evolution and its concomitant, cultural evolution have directed humans on a disparate course. Knowing that we have a pleasure centre in our brain, we are tempted to exploit it to procure pleasure as a ‘free lunch’; and knowing that we have the technical means to eradicate suffering, we are ready to use them. The discoverers of the reward centres, Olds and Milner found that rats who were electrically stimulated in the septal areas of their

limbic system would prefer stimulation to food and water [13]. Female rats would even abandon their unweaned pups to self-stimulate until they died from exhaustion. In contrast to the natural hedonic treadmill, direct stimulation results in no saturation, and hence no hedonic accommodation [7]. Natural selection has provided animals with brain reward centres, but not with a means to enable self-stimulation. “The brain mechanisms that make animals susceptible to brain stimulation reward evolved long before the human inventions that make intracranial self-stimulation or drug addiction possible” [43].

**A**rtificial brain stimulation by electrical currents or by drugs replaces the meaningful natural activities of observing the environment and acting appropriately—in this way, stimulation functions as an unusual reward, as a single response that suffices both to procure and ‘consume’ it. It is, in fact, a short-circuiting of the natural mechanisms. Still, there have

been many utopians who envision that drugs will help us to achieve a perfect happiness. A recent book, *The Road to Happiness* [44], for example, predicts that the universal use of electrical brain stimulation will allow “direct access to intensive pleasure”.

**We have been moulded by evolution not to be happy, but to act on the phantasm of happiness**

It can be argued that this would only be a refinement and ultimate perfection of what a human individual is trying to achieve by imagination and daydreaming and what has been the ambition of art from time immemorial. However, genuine art has always provided complex emotions, including both ecstasy and sorrow, and it has been part of traditional ‘normative culture’, whereas the products of the modern entertainment business are designed on purpose to satisfy personal demands for fun and amusement. Their effects might soon

become indistinguishable from the effects of drug and electrical brain stimulation.

Science is certainly getting involved in the business of pleasure. Brain-enhancing drugs are being studied and 'brain viagra' might soon be available for consumers to reinvigorate mental activity. The philosopher David Pearce, author of *The Hedonistic Imperative*, believes that no pain, physical or emotional, is necessary, and that we should strive to "eradicate suffering in all sentient life". He describes this project as "technically feasible" thanks to genetic engineering and nanotechnology, and as "ethically mandatory" on utilitarian grounds [45]. Extrapolation from the ceaseless expansion of the entertainment industry gives credence to Neil Postman's prediction, which he expressed dryly in the title of his book: *"Amusing Ourselves to Death"* [46].

**Occasionally, the intense enjoyment of the present can escalate to reach a singularity of 'peak experiences', the "single most joyous, happiest, most blissful moments of life"**

Totally eliminating suffering and blindly chasing pleasure are not paths to happiness. Posters on buses in London and other world capitals with the inscription "There's probably no God. Now stop worrying and enjoy your life", give false advice. A programme of 'mass happiness' is actually a delusion. Happiness cannot be a set goal sold as a consumer good. It can only spring up as a by-product of pursuing long-term goals, intermittent with negative and positive emotions. "Sustainable happiness results from what we do, not from what we have" [47]. Chasing happiness as an aggregate of wealth and pleasure is a vicious spiral. A huge number of empirical studies show that vast amounts of material wealth do not make people happier once they have reached a certain level of financial security [1,27,48,49]. The data from public polls and surveys of researchers on happiness, which show that most people in welfare societies describe their lives as 'generally happy', might be misleading—what other answer would you expect from a person who feels secure and has the impression of having easy access to anything commonly valued and extolled? Maslow warned us 40 years ago that "We must say harshly of the 'science'

of economics that it is generally the skilled, exact, technological application of a totally false theory of human needs and values, a theory which recognizes only the existence of lower needs or material needs" [27].

**C**an this be changed? Our knowledge of the vagaries of evolution and of the human brain can hardly be disseminated to the majority of the human population. Such insight would be counterbalanced by the enormous inertia of the pleasure-oriented economy and its wealthy masters. Humanity is doomed to follow its evolutionary destiny.

All this does not exclude the possibility that enlightened individuals can achieve happiness. Long before modern science, several thinkers anticipated the pitfall of the hedonic treadmill even if they had no means to cope with physical pain. The Greek philosopher Epicurus (342–270 BC) advised people to accept pain with equanimity and countervail it by concentrating the mind on past pleasures; but he placed his main emphasis on the positive side and his full recipe for happiness was to moderate our desires to the point where we can enjoy their genuine and lasting satisfaction [50].

The French philosopher Michel Eyquem de Montaigne (1533–1592) gathered much inspiration from Epicurus, but he got most of his insights from subjecting his own carnal being to thorough scrutiny. Indeed, a biologist can read his essays as painstaking laboratory protocols and extract an important message [51]. The thin 'monomolecular layer' of consciousness on the 'ocean of the unconscious' opens a possibility not just to feel, but also to amplify the rich contents, which our limbic system, relayed by the neocortex, offers us. We can enhance the experience of every single moment of sorrow or joy to live them intensively 'here and now'. Even any simple sensual gratification should not be perceived automatically, but with the conscious perception of its hedonic quality.

**T**here are feelings that give value to past experiences and, through our imagination and daydreaming, emotionally charge the future. This is the substance of happiness as defined at the onset of this essay. It also transcends personal limitation by sharing emotions with other people, without dissolving one's 'I' in vague and amorphous mindless actions, "the loss of self-consciousness during an absorbing activity", recommended by some

contemporary researchers on happiness under the notion of 'flow'. Occasionally, the intense enjoyment of the present can escalate to reach a singularity of 'peak experiences', the "single most joyous, happiest, most blissful moments of life" [27]. After all, there is a collection of these rare peak experiences, filled with Kantian sublimity, that give human life meaning and worth.

Focusing on the experience of the present is not a commandment to *carpe diem* (seize the day). The symptom of the decay of the modern consumer society—chasing instantaneous gratification of all needs and wants—is a process of continuous 'de-cortication' of humans, obnubilation of intellect, abolition of 'living within time'. The heightened experience of the present means "to live eternity in seconds", as the astronomer Milan Štefánik (1880–1919) expressed it. But it also means to accept with serenity the message of 'finitics' about the ultimate fate of the human species [18]. Following Michael Shermer, "Rather than crushing our spirits, the realization that we exist together for a narrow slice of time and space elevates us to a higher plane of humanity and humility: a proud, albeit passing, act in the drama of the cosmos" [52].

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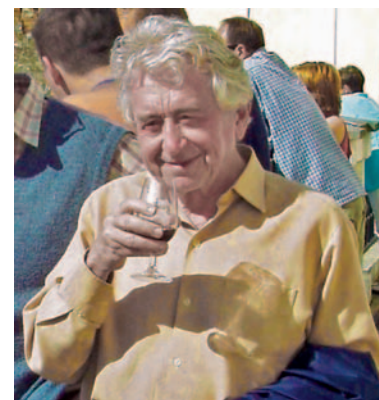
#### CONFLICT OF INTEREST

The author declares that he has no conflict of interest.

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